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EQUIPMENT TO AID IN MANUAL SORTING OF ADULT CODLING MOTHS BY SEX

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ABSTRACT

Equipment was developed to aid in manual sorting of male and female codling moths, *Laspeyresia pomonella* (L.), with minimum injury. To keep the insects immobile, ambient temperatures were maintained at 2° to 3° Celsius. Workers separated the insects by using a camel's hair brush to sweep them from a rotating-disk separating table into side containers. Sorting rate was 1,100 insects per man-hour or, with three workers, 3,300 insects per hour per machine. Errors in sexing ranged from 0 to 2 percent.

KEYWORDS: Sorting; codling moths; mechanical sorting aid.

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EQUIPMENT TO AID IN MANUAL SORTING OF ADULT CODLING MOTHS BY SEX

By L. G. Schoenleber, R. E. Short, and L. D. White[1]

INTRODUCTION

Many studies in the control of native codling moths, *Laspeyresia pomonella* (L.), require the use of only one moth sex. Sorting adult insects manually, according to sex, is slow and costly and can cause insect injury during handling. A worker, using a tweezer, can sort only 500 adult moths per hour. Mechanical aids or automatic sorting can hasten manual sorting, reduce costs, and minimize insect injury.

In an earlier study, in which codling moth pupae were sorted, principles of separation by size, density, electrostatic attraction, and surface texture were compared.[2] In another study, cabbage looper pupae were mechanically placed under a microscope for identification and sorting.[3]

Adult codling moths are more difficult to manipulate than are the pupae.[4] Furthermore, adult codling moths need to be immobilized during sorting to prevent their crawling. A small percentage of immobile male and female adult codling moths have been sorted effectively by the use of sizing rolls with a tapered opening between the upper and lower ends. However, many adult moths overlap in size and could not be sorted by sex.

Sexing is a critical problem in release experiments with sterile insects. In 1973, two release areas in Yakima, Wash., were designated as single-sex sites.[5] This study was conducted to develop a method by which the adult codling moths could be easily and rapidly sorted by sex.

METHODS AND MATERIALS

A relatively fast sorting system was developed that safely immobilized the moths by chilling them. The unit consisted of an adjustable, open end, and vertical supply cylinder mounted (with clearance) above a flat-disk metering table.

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[1] Agricultural engineer, engineering technician, and research technologist, respectively, Yakima Agricultural Research Laboratory, 3706 W. Nob Hill Boulevard, Yakima, WA 98902.

[2] Schoenleber, L. G., B. A. Butt, and L. D. White. Equipment and methods for sorting insects by sex. U. S. Dept. Agr., Agr. Res. Serv. ARS 42-166, 21 pp. 1970.

[3] Wolf, W. W., M. M. Stimmann, and G. K. Parker. A mechanism to aid sorting of male and female cabbage looper pupae. Jour. Econ. Ent. 65(4): 1044-1047. 1972.

[4] See footnote 2.

[5] White, L. D., R. B. Hutt, H. R. Moffitt, and others. Codling moths: Effects of releasing irradiated mixed sexes on females or males only on reproductive potential of a native population. Jour. Econ. Ent. (In press).

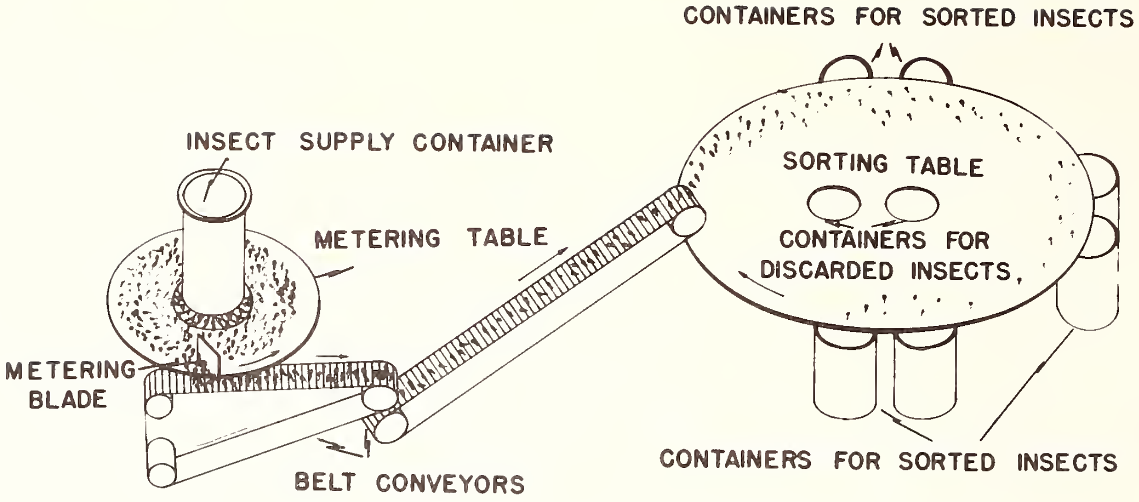
CONTAINERS FOR SORTED INSECTS
INSECT SUPPLY CONTAINER
SORTING TABLE
METERING TABLE
CONTAINERS FOR DISCARDED INSECTS
METERING BLADE
BELT CONVEYORS
CONTAINERS FOR SORTED INSECTS

Figure 1.--Schematic of equipment to aid sorting of male and female adult codling moths.

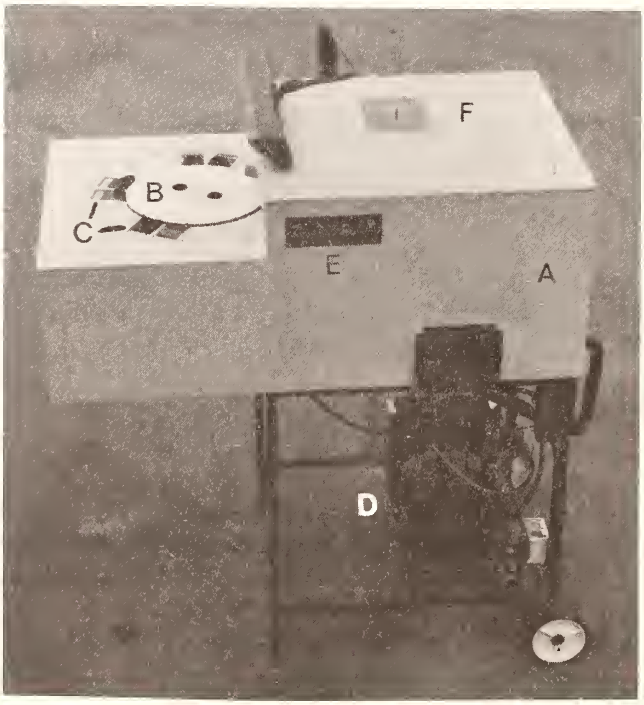

Figure 2.--Equipment to aid in manual sorting of adult codling moths by sex. *A*, outside cover of refrigerated box; *B*, revolving disk onto which immobilized chilled insects are dispensed from belt conveyor, which is located inside of the refrigerated box. The recessed containers near the center of the disk are used to dispose of weak and dead insects; *C*, recessed containers around the periphery of rotating disk are provided to hold sexed insects; *D*, refrigerator compressor; *E*, electrical control switches for controlling operation of insect belt conveyor rotating disks and compressor motor; and *F*, lid over insect metering container, which is located inside the refrigerated box.

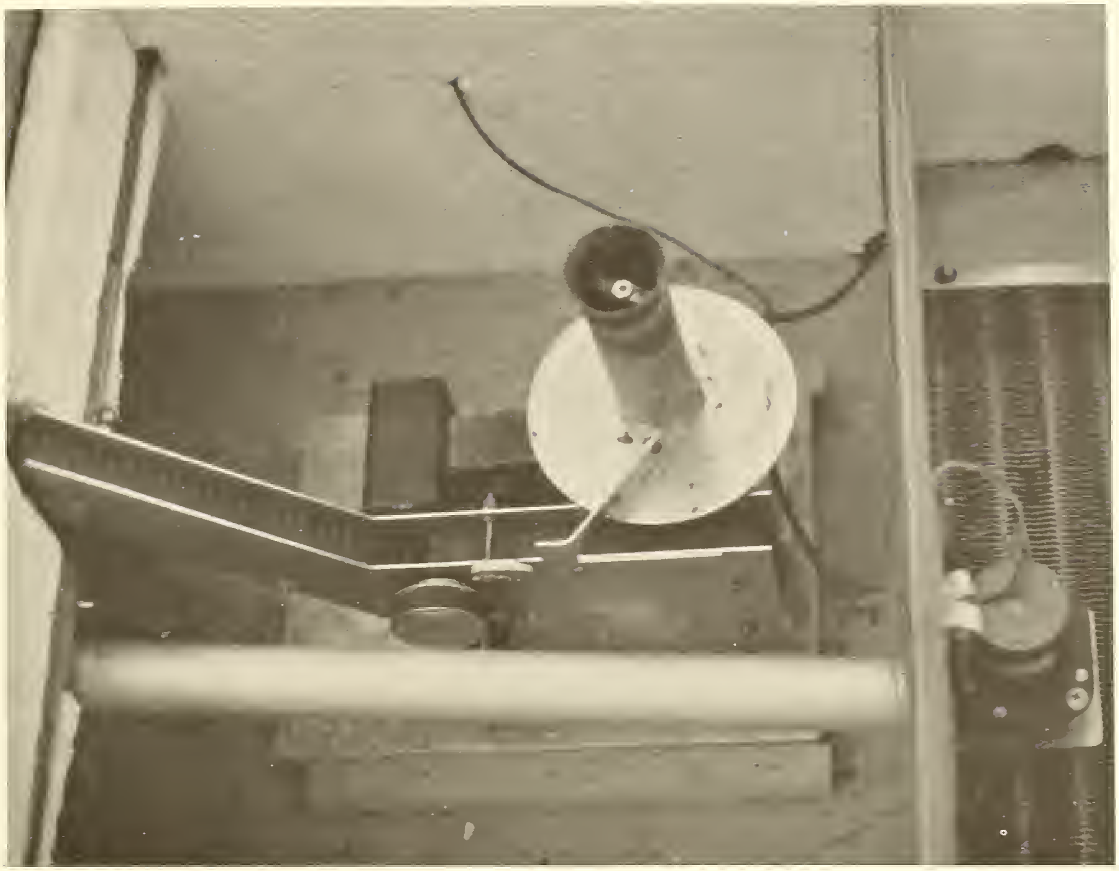

Figure 3.--Equipment with top cover removed showing metering mechanism and cooling coils.

The disk had a short cone at the center of rotation that extended upward inside the cylinder. The cylinder and the disk rotated together.

The metering table (fig. 1) was 6 inches (152 mm) in diameter and rotated 1/2 revolution per minute (r/min). The horizontal conveyor belt was 1 inch (25 mm) wide, had a 1/16-inch (2 mm) ridge every two-tenths of an inch (5 mm), and moved 7 inches (178 mm)/min. A similar belt on the incline traveled 28 inches (711 mm)/min. The sorting table was 12 inches (305 mm) in diameter and rotated 1 r/min. A second sorting table, 18 inches (457 mm) in diameter, was built to provide a larger area for the workers to sort insects. Except for the sorting table, the entire sorting system was enclosed and cooled with a one-third horsepower refrigeration system (figs. 2 and 3). Cold air was circulated against the bottom of the sorting table to keep the surface cool. A circulating fan maintained a surrounding temperature of 2° to 3° Celsius. Insects remained cold and immobile while they were on the sorting table.

Insects were allowed to spill from the bottom of the supply cyclinder, over the cone, and onto the rotating metering table. The insects were moved from the table with an adjustable stationary blade onto a horizontal conveyor belt and, then, onto a rotating-disk sorting table.

The sorting table had ample space for three workers. Workers at the table used camel's hair brushes to sweep healthy insects, according to sex, into designated holding containers beside the table. Dead and injured insects were swept into containers near the center of the sorting table. Insects were distributed sparsely on the sorting table for ease in insect identification.

The insect feed rate was regulated by connecting electrical switches to the motors that drove the metering components. For flexibility in operation, the sorting equipment had separate switches for the refrigeration unit, insect supply container, belt conveyors, and sorting table.

Each hour, a supply of insects was brought from a cold holding room and placed in the supply container of the sorting equipment. The sorted insects were removed at least once each hour and placed in a cold holding room. This procedure minimized the time that insects remained at an immobilizing temperature.

RESULTS

Insects were sorted at an average rate of 1,100 insects/man-hr by machine (3,300 insects/hr/machine for the three workers). Sorting errors ranged from 0 to 2 percent. Mating and behavior tests showed no deleterious effects to moths from the sorting process. The 12- (305 mm) and 18-inch (457 mm) sorting tables each gave the same sorting efficiency.

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